Radio Frequency (RF) Radiation Hazard Study
FAA ASTI Kotzebue 3.6 meter

This report summarizes the non-ionizing radiofrequency (RF) exposure levels associated with the above antenna system. RF prediction models and associated exposure limits referenced in this study are outlined in the Federal Communications Commission (FCC) Office of Engineering and Technology (OET) Bulletin 65 Edition 97-01 (August 1997). The FCC-exposure limits define the level of RF energy that a person may be continuously exposed without experiencing adverse health effects. This "safe" level, herein referred to as Maximum Permissible Exposure (MPE) limit, is comprised of two-tiers: one for conditions which the public may be exposed (General Population/Uncontrolled) and the other for exposure situations usually involving workers (Occupational/Controlled). Therefore, the intent of this study is to define the maximum "worst-case" RF exposure levels and compare the results relative to the applicable MPE limits.

Based upon the following system parameters, the applicable **MPE limits** are: **1.0** mW/cm^2 and **5.0** mW/cm^2 for General Population/Uncontrolled and Occupational/Controlled environments, respectively, as specified in 47 CFR Part 1.1310.

System Parameters

Antenna Diameter (D_1):	3.6	meters	Antenna Surface Area (A_{D1}):	10.18	$meters^2$
Operating Frequency:	6175	MHz	Wavelength (λ):	0.049	meters
Antenna Gain (G), @ 6175 MHz:	45.6	dBi	Numerical Gain:	36307.8055	
Input Power at antenna flange*****:	200.0000	watts			
Calculated Aperture Efficiency (η):	0.67		Antenna centerline height (AGL):	2.00	meters

***** Based on a 1 W maximum microwave transceiver power output with 8 RF carriers. For purposes of this study, this equates to an aggregate output EIRP for all carriers of

68.6 dBW maximum.
7,261,561 watts maximum

Hazard Assessment

For parabolic aperture antennas, three (3) regions are defined for predicting maximum RF exposure levels within the main-beam (on-axis) path: near-field, transition, and far-field regions. RF prediction methods are based on where the point-of-interest falls within these regions:

1. The far field (R_{ff}) region is determined by the following equation: $0.6\ D^2/\lambda$. This equates to a linear distance of approximately **160.06** meters from the antenna. The maximum main beam RF exposure level (S_{ff}), in terms of power density units, at this point can be calculated as follows:

$$S_{ff} = PG / 4\pi(R_{ff})^2 = \quad 22.56\ W/m^2 \quad \mathbf{2.26}\ mW/cm^2$$

2. The near field (R_{nf}) region is determined by the following equation: $D^2/4\lambda$. This equates to a linear distance of approximately **66.69** meters from the antenna. The maximum RF exposure level (S_{nf}), in terms of power density units, within this region can be calculated as follows:

$$S_{nf} = 16\eta P/\pi\ (D_1)^2 = \quad 52.66\ W/m^2 \quad \mathbf{5.27}\ mW/cm^2$$

(Assume maximum value maintained throughout the near field region)

****** The transition (R_t) region is between the near-field and far-field regions, defined as $R_{ff} - R_{nf}$. This equates to a region extending **93.37** meters, beginning at **66.69** meters and ending **160.06** meters from the antenna. While the exposure intensity decreases inversely with the square of the distance in the

Hazard Assessment - Continued

far field region, the exposure intensity decreases inversely with distance in the transition region. Therefore, the maximum RF exposure level in the transition region will not exceed the above calculated near field value (S_{nf}). If the point-of-interest falls within the transition region, the estimated RF exposure level (S_t), in terms of power density units, can be calculated using the following mid-point (R_t) example:

$S_t = S_{nf} * R_{nf} / R =$ **3.10** mW/cm^2 - at mid-point of R_t

note: where 'R' is the point-of-interest within the R_t

This prime focus antenna design uses a focal-point feed horn to direct RF energy towards the main reflector dish. The following calculations are used to predict the RF exposure levels at the main reflector surface and feed horn aperture:

3. The maximum RF exposure level ($S_{main\text{-}surface}$) in front of the main reflector surface (at rim), in terms of power density units, can be calculated as follows:

$S_{main\text{-}surface} = 4*P / A_{D1} =$ **78.60** W/m^2 **7.86** mW/cm^2

For evaluating accessible areas outside the main beam path, a practical estimation is to consider the maximum allowable gain pattern envelope for fixed-satellite services. Specifically, the antenna gain shall lie below the envelope defined as -10 dBi for angles greater than 48 degrees and less than/equal to 180 degrees from the main lobe axis. In considering areas immediately below the main reflector rim, the maximum RF exposure levels directed towards this region (Spoi), in terms of power density units, can be calculated as follows:

4. $S_{poi} = (0.1)PG/4\pi(R)^2 =$ 0.49122 W/m^2 **0.049122** mW/cm^2

Note *: where 'R' is the point-of-interest is just below antenna rim, which equates (in this case) to a centerline distance:* **1.8** meters

Radiofrequency (RF) Radiation Hazard Study - Continued
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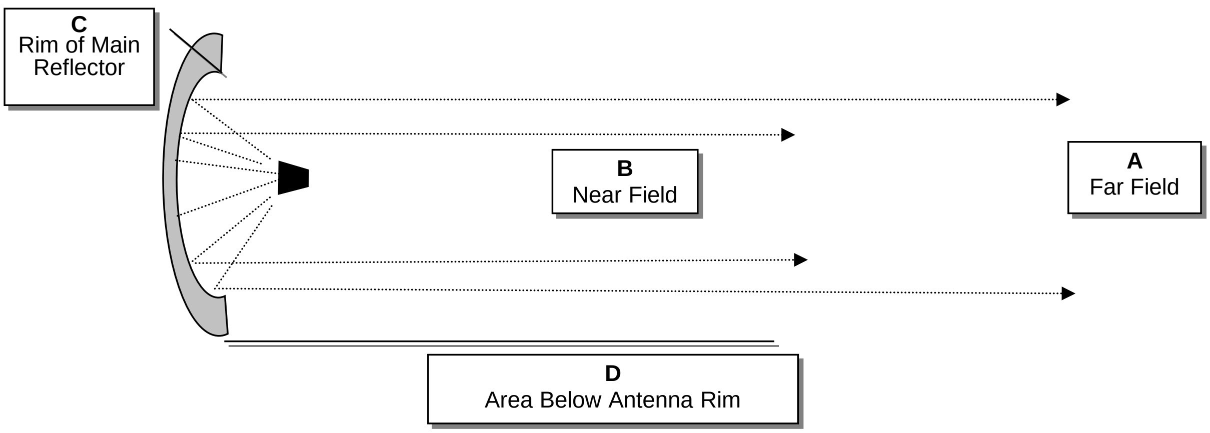
Hazard Assessment - Summary

Summary of Calculated RF Exposure Levels

Region			Level (mW/cm^2)	Assessment
A. Far Field (Rff),	160.06	meters, =	2.2557	Exceeds FCC Public/Uncontrolled MPE Limit
B. Near Field (Rnf),	66.69	meters, =	5.2657	Exceeds FCC Occupational MPE Limit
C. Rim of Main Reflector =			7.8595	Exceeds FCC Occupational MPE Limit
D. Area below Antenna Rim =			0.04912190	Satisfies FCC MPE Limits



Conclusion

The results of this study indicate that accessible ground level areas, surrounding the antenna base and horizontal to the main beam axis, do not exceed the most restrictive FCC-General Population/UncontrolledMPE limit.

The highest RF exposure levels are isolated to regions located between the feed horn and main reflector surface, which are typically inaccessible during normal operations. To ensure compliance with the FCC-Occupational/Controlled MPE limit, the antenna system shall be de-energized during any maintenance/service activities occurring within the main reflector or feed horn regions.

This study concludes that operation of this station will not expose workers or public members to RF levels in excess of the applicable MPE limits. Therefore, in accordance with 47 CFR Part 1.1307 (b), preparation and submission of an Environmental Assessment (EA) is not required.

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